Revista Hábitat Sustentable Vol. 14, N°. 2. ISSN 0719 - 0700 / Págs. 98 - 111
https://doi.org/10.22320/07190700.2024.14.02.08

Recibido 10/09/2024
Aceptado 09/12/2024

HABITATION PRACTICES FOR ADAPTATION AND RESILIENCE IN AN AMPHIBIOUS ENVIRONMENT IN COLOMBIA

PRÁCTICAS DEL HABITAR HACIA LA ADAPTACIÓN Y RESILIENCIA EN UN ENTORNO ANFIBIO EN COLOMBIA

PRÁTICAS DE HABITAÇÃO PARA ADAPTAÇÃO E RESILIÊNCIA EM UM AMBIENTE ANFÍBIO NA COLÔMBIA

Angélica Chica-Segovia
Doctora en Arte y Arquitectura
Profesora asociada, Escuela de Arquitectura y Urbanismo, Facultad de Artes
Universidad Nacional de Colombia, Bogotá, Colombia
https://orcid.org/0000-0002-3172-1543
achicas@unal.edu.co

Revista Hábitat Sustentable Vol. 14, N°. 2. ISSN 0719 - 0700 / Págs. 98 - 111
https://doi.org/10.22320/07190700.2024.14.02.08

RESUMEN

La Gran Depresión del Caribe colombiano ubicada en la macrocuenca Magdalena-Cauca, enfrenta una degradación ecosistémica significativa, debido a actividades antropogénicas que han impactado negativamente el hábitat y la calidad de vida de sus habitantes. Este artículo presenta el avance del proyecto Yuma: diversidad cultural infinita, centrado en la identificación de indicadores de adaptación y resiliencia de las comunidades frente a los retos contemporáneos relacionados con el agua de sus humedales, que enfatiza el valor de los saberes y prácticas locales. A través de una metodología cualitativa etnográfica, se exploran las tres subregiones: La Mojana, la Depresión Momposina y la Zapatosa, en que se busca delinear estrategias multiescalares para intervenciones que respeten el habitar tradicional y fomenten la autogestión y la gobernanza. Los resultados preliminares destacan la necesidad de políticas públicas que reconozcan las prácticas locales y fortalezcan la capacidad adaptativa de las comunidades, que aseguren su resiliencia ante los desafíos ambientales actuales.

Palabras clave
aguas superficiales, arquitectura vernácula, cultura del Caribe, adaptación al cambio climático.

ABSTRACT

The Colombian Caribbean Great Depression, located in the Magdalena-Cauca macro-basin, faces significant ecosystem degradation due to anthropogenic activities that have adversely affected its inhabitants' habitat and quality of life. This article presents the progress of the Yuma project - infinite cultural diversity, which focuses on identifying adaptation and resilience indicators for the communities to face contemporary challenges related to the water of their wetlands, emphasizing the value of local knowledge and practices. Three sub-regions are explored through a qualitative ethnographic methodology: La Mojana, the Momposina Depression, and La Zapatosa, which seeks to outline multi-scale strategies for interventions that respect traditional habitation and foster self-management and governance. Preliminary results highlight the need for public policies that acknowledge local practices and strengthen the adaptive capacity of communities to ensure their resilience when facing current environmental challenges.

Keywords
surface water, vernacular architecture, Caribbean culture, climate change adaptation.

RESUMO

A Grande Depressão do Caribe colombiano, localizada na macrobacia de Magdalena-Cauca, enfrenta uma degradação significativa do ecossistema devido a atividades antropogênicas que afetaram negativamente o hábitat e a qualidade de vida de seus habitantes. Este artigo apresenta o progresso do projeto Yuma: diversidade cultural infinita, focado na identificação de indicadores de adaptação e resiliência das comunidades diante dos desafios contemporâneos relacionados à água de suas zonas úmidas, o que enfatiza o valor do conhecimento e das práticas locais. Por meio de uma metodologia etnográfica qualitativa, as três sub-regiões foram exploradas: La Mojana, La Depresión Momposina e La Zapatosa. O objetivo era delinear estratégias multiescalares para intervenções que respeitassem a habitação tradicional e promovessem a autogestão e a governança. Os resultados preliminares destacam a necessidade de políticas públicas que reconheçam as práticas locais e fortaleçam a capacidade de adaptação das comunidades para garantir sua resiliência diante dos atuais desafios ambientais.

Palavras-chave:
águas de superfície, arquitetura vernacular, cultura caribenha, adaptação às mudanças climáticas.

Revista Hábitat Sustentable Vol. 14, N°. 2. ISSN 0719 - 0700 / Págs. 98 - 111
https://doi.org/10.22320/07190700.2024.14.02.08

INTRODUCTION

The GDC (Great Depression of the Caribbean), located in the north of Colombia in the Magdalena-Cauca macro-basin, comprises La Mojana, the Momposina Depression, and the Zapatosa Marsh, from the departments of Córdoba, Sucre, Bolívar, Magdalena, and Cesar. These wetlands regulate the Magdalena, Cauca, San Jorge, and Cesar rivers, with an average temperature ranging from 24 to 37°C, rainfall from 17 to 137 mm, and humidity from 82 to 100%. Their rising dynamics and low-lying water bodies have four hydrological conditions: low, rising, high, and falling waters, depending on how the ecosystem is organized.

The riparian wetlands and their water pulses are fundamental ecosystems that act as flood buffers by decanting and accumulating sediment from tributary rivers (National University of Colombia - Observatory of Environmental Conflicts [OCA, in Spanish] and Institute of Environmental Studies [IDEA], 2017). This benefits agricultural and fish farming use, generating habitats for a large number of living beings, with a high number of environmental services (RAMSAR, 2018). However, this has led to over-exploitation and degradation, making them vulnerable and putting communities at risk (Torremorell et al., 2021).

These have been the support structure for amphibian and surrounding communities that inhabit them interdependently, providing them with much of what they need and requiring their protection. Historically, there has been an adaptation to this ecosystem, as is the case of the hydraulic works of the Zenú indigenous group (Olmos-Severiche et al., 2022) (Figure 1), in interaction with the dynamics of water. However, since the Spanish colonization in the sixteenth century, some activities throughout the macro-basin and climate change have modified productive practices and ways of living, putting the socio-ecosystem at risk (Calderón-Contreras, 2021).

Although wetlands are resilient and can self-repair, human interaction affects this possibility (Folke, 2003, cited in Medina et al., 2014). This sometimes irreversibly affects the habitat, making reciprocal actions that allow restoring the socio-ecosystem balance a matter of urgency (Torres-Carral, 2021).

Conflicts and obstacles that affect their conservation have been evidenced, such as hydrological transformations, weaknesses in socio-ecological management, scarce knowledge and valorization by society, insufficient efforts in conservation and sustainable use, low intervention with a focus on resilience and adaptation, and limited technical capacities of management and territorial planning (National Council of Economic and Social Policy Republic of Colombia. National Planning

Figure 1. Zenú channels in Las Flores, Sucre. Source: Preparation by the authors.

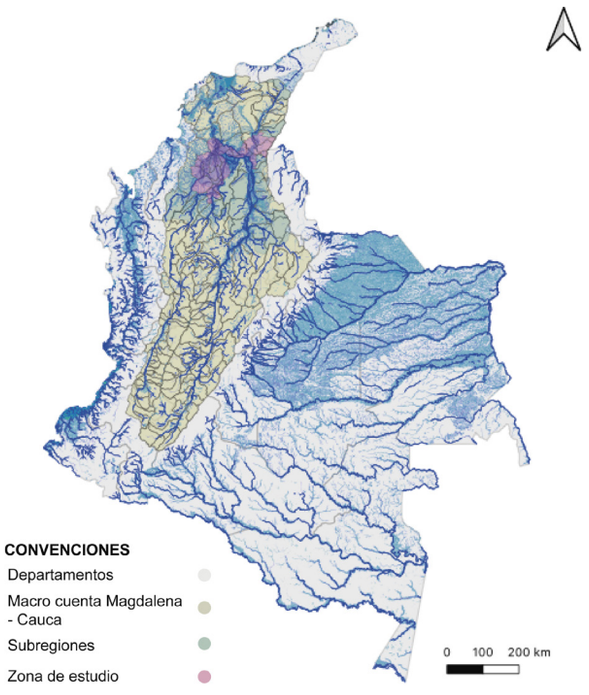

Figure 2. Magdalena-Cauca Macro-basin. Source: Preparation by María Camila Ramos Zapata.

Department [CONPES], 2022; Vargas et al., 2023). This compels integrated regional management solutions to be implemented based on knowledge, conservation, and the sustainable use of natural and cultural capital to avoid reaching the point of no return.

This issue has become relevant due to the hydrological and climatic emergencies that affect the population's

Revista Hábitat Sustentable Vol. 14, N°. 2. ISSN 0719 - 0700 / Págs. 98 - 111
https://doi.org/10.22320/07190700.2024.14.02.08

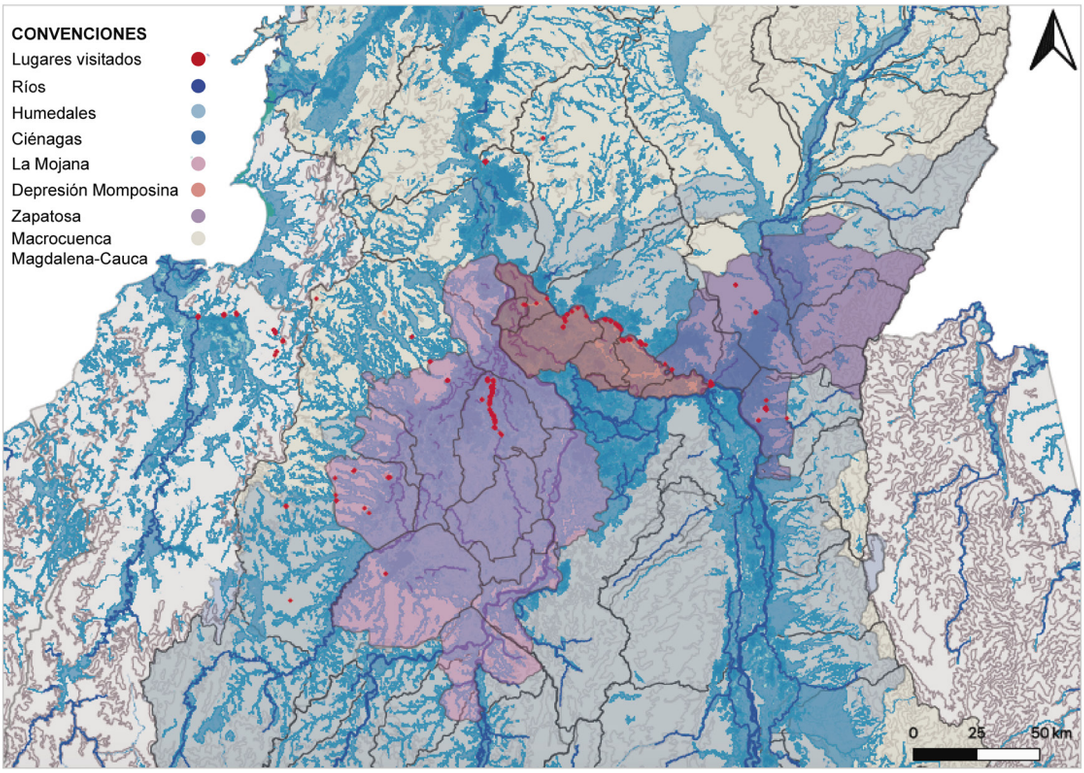

Figure 3. Route made in the GDC. Source: Preparation by María Camila Ramos Zapata.

stability (Rivera-Cediel, 2024). There are numerous studies and related regulations such as (de Nieto & Falchetti, 1981; Aguilera-Díaz, 2004; Aguilera-Díaz, 2011; OSSO Corporation, 2013; Vargas et al., 2023; Pan American Health Organization [PAHO] and World Health Organization [WHO], 2023; Torres Solórzano, 2023), but their approach is still centralist (Billon et al., 2020) selective or fragmented, in a complex region. Indeed, sometimes, the implications of water cycles or the factors that impede facing the challenges related to economic interests and armed conflict are not understood (Diz Diz, 2021).

Specific solutions have also been given that are adapted to types of infrastructure and housing (Palencia Mendoza, 2019; García-Reyes Röthlisberger & Fajardo, 2019; Mosquera-Torres & Calderón-Franco, 2022), which shows the need for more significant multiscale efforts that integrate natural dynamics and community knowledge as leading actors in the handling of these ecosystems (Smardon, 2006).

The research project aims to promote actions that rebalance socio-ecosystem relationships, strengthening the capacity to respond to change (Nguyen et al., 2022) and improving communities' quality of life and social mobility. It seeks to promote comprehensive attention to the ecoregion and its macro-basin, which counteracts the centrality in managing the territory and its ecosystem (Jaimes Pereira & Zerbone Alves de Albuquerque, 2022). The line presented in the article focuses on living practices and architecture, documenting evidence of adaptation and resilience (Coscia & Voghera, 2022) to current conditions. This enabled the generation of preliminary inputs to support locally adapted, co-produced, and located interventions within a self-management and community governance framework to formulate effective public policies at the territory's national, regional, and local management levels.

METHODOLOGY

This began with a bibliographic review, looking at the documentation and socio-ecosystemic characterization in the three zones: La Mojana, the Momposina Depression, and La Zapatosa (Figures 2 and 3). Representative cases were chosen using intentional sampling, semi-structured interviews, life stories, and participant observation.

The information was analyzed using socio-ecosystemic characterization sheets (Figure 4), divided into the categories of ecosystem, ways of living, architecture, conflicts and threats, adaptation, and resilience indicators.

Figure 4. Characterization tool. Source: Preparation by the authors.

RESULTS

LIVING PRACTICES

The significant biodiversity of these ecosystems provided by the water pulses in rivers, streams, lagoons, swamps, marshes, and forests (Camacho, 2015), has historically led communities to settle on their banks, forcing them to adapt to hydrological dynamics, with a calendar to meet their needs (Figure 5). The architecture and the way of occupying the territory reflect these dynamics. Constructive and productive practices such as fishing, agriculture, and hunting respond to the climate, the water bodies, and the periods of the year marked by growth from January to October with abundant fishing. Then comes the summer season that fertilizes the land for planting, and although fishing decreases, it is when the fish spawn, preparing for the next season. In addition, the fresh pastures of the dry season are used for livestock migration from the savannas, establishing a close relationship between the highlands and the wetlands.

Each period implies the availability of resources for food security, construction, and the trade of

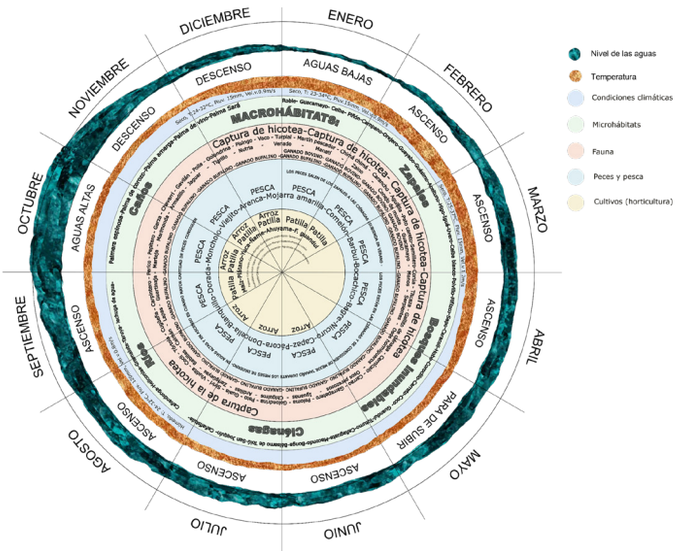

Figure 5. Ecological calendar of the GDC. Source: Preparation by the authors.

surpluses, which has historically generated very close ties with the riparian populations and those around them. Figure 6 shows the two moments in each of the microhabitats.

Revista Hábitat Sustentable Vol. 14, N°. 2. ISSN 0719 - 0700 / Págs. 98 - 111
https://doi.org/10.22320/07190700.2024.14.02.08

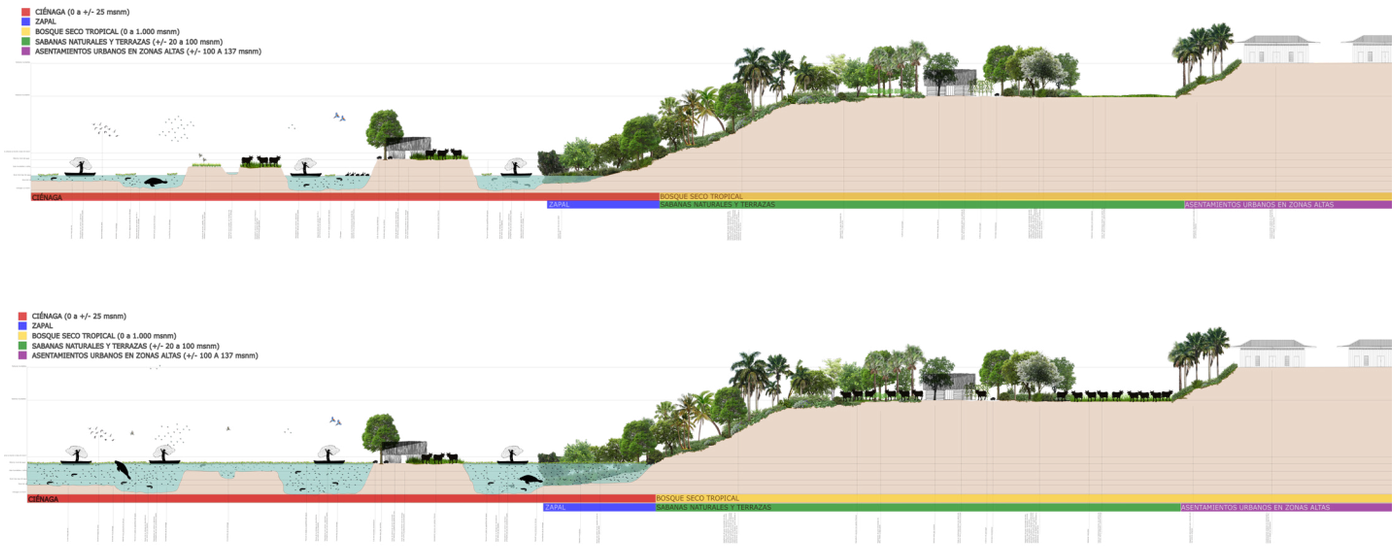

Figure 6. Ways of living in the natural savanna, natural tropical dry forest, marsh, and swamp intersection in high and low waters. Source: Preparation by the authors.

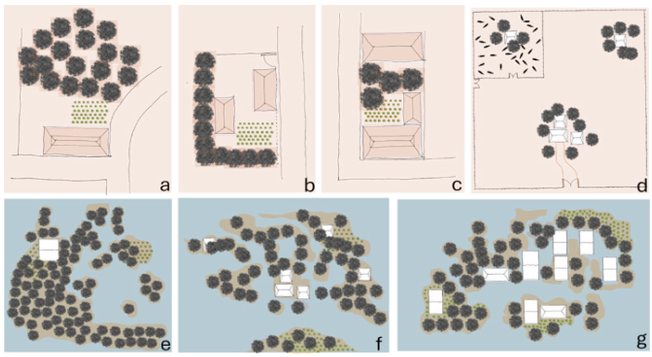

Figure 7. Types of layout: a, b, and c urban; d. rural productive; e, f, and g in the marsh. Source: Preparation by the authors

HABITAT AND ARCHITECTURE

Traditional architecture and layout are maintained, with extended single-volume constructions generally using non-attached volumes (Figure 7, a-g). In the productive properties, the grouped construction is surrounded by infrastructure for complementary activities such as livestock and horticulture (d).

In most cases, they have one floor and, exceptionally, two or more, especially in urban buildings that show the wealth of other times, such as in Sucre, San Marcos, and El Banco. The building is always accompanied by low, medium, and high vegetation to provide shade and, in some cases, food, often complemented by subsistence crops (Camacho Segura & Robledo Escobar, 2020), even in urban areas (Figure 8).

Figure 8. Setup in productive (above), urban (in the center), and swamp (below) areas. Source: Preparation by the authors.

Revista Hábitat Sustentable Vol. 14, N°. 2. ISSN 0719 - 0700 / Págs. 98 - 111
https://doi.org/10.22320/07190700.2024.14.02.08

Each ecosystem involves the use of the available surrounding materials and suitable bioclimatic response, adapted to the water cycles, with predominantly masonry, half-timbered, and embedded adobe in rural or urban dry areas, half-timbered in American oil palm and sometimes wood constructions in flood zones. Each has a rod foundation in the ground, except for masonry that rises on large stones. Zinc roofs also stand out, replacing those of savannah and Macauba palm, modifying the dwelling's comfort, which is complemented by the surrounding vegetation (Figure 9, Figure 10, Figure 11, Figure 12, Figure 13, Figure 14, and Figure 15).

CARACTERIZACIÓN DEL HÁBITAT Y LA ARQUITECTURA TRADICIONAL EN LA DEPRESIÓN MOMPOSINA					
TIPOLOGÍA		CARACTERÍSTICAS CONSTRUCTIVAS			
		CERRAMIENTOS		CUBIERTAS Y ENTREPISOS	
REGISTRO	TIPO	SISTEMA	MATERIALES	SISTEMA	MATERIALES
a. Urbana					
	Terrestre- A nivel del suelo	Bahareque con envarado vertical	Madera Nepa de corozo	Par, hilera y solera	Madera Palma amarga y de vino
					Madera Teja de zinc
		Bahareque embutido	Madera Nepa de corozo + barro	Par, hilera y solera	Madera Palma amarga y de vino
					Madera Teja de zinc
		Entramado	Madera	Par, hilera y solera	Madera Palma amarga y de vino
					Madera Teja de zinc
		Mampostería simple	Ladrillo	Par, hilera y solera	Madera Teja plana
					Madera Teja de barro
					Madera Teja de zinc
b. Rural					
	Terrestre-A nivel del suelo	Bahareque con envarado vertical	Madera Nepa de corozo	Par, hilera y solera	Madera Palma amarga y de vino
					Madera Teja de zinc
		Bahareque embutido	Madera Nepa de corozo	Par, hilera y solera	Madera Palma amarga y de vino
					Madera Teja de zinc
		Entramado	Madera	Par, hilera y solera	Madera Palma amarga y de vino
					Madera Teja de zinc

Figure 9. Technical characterization of the architecture in the three zones. Source: Preparation by the authors.

Figure 10. Traditional urban masonry house. El Banco. Source: Preparation by the authors.

Figure 11. Urban masonry houses, Sucre. Source: Preparation by the authors.

Figure 12. Traditional urban half-timbered house, San Marcos. Source: Preparation by the authors.

Figure 13. Traditional urban house using American oil palm, Santiago Apostol. Source: Preparation by the authors.

Figure 14. Traditional rural house in embedded adobe, La Zapatosa. Source: Preparation by the authors.

Figure 15. Traditional house in the marsh using American oil palm, San Marcos. Source: Preparation by the authors.

CONFLICTS AND THREATS

The socio-ecological balance of the macro-basin and the GDM wetlands has been altered by the changing water cycles due to upstream infrastructure works such as dams, dikes, and highways, among others, making it unsustainable (Greco & Larsen, 2014). Climate change has adjusted cycles and their duration, as has pollution (Meza-Martínez et al., 2020) and water sedimentation caused by mining activities (Urango-Cárdenas et al., 2024); the use of agrochemicals (Camacho, 2017) and monoculture, which put communities at risk (Marrugo-Negrete et al., 2024). The desiccation of the land for productive and extractive purposes, the abandonment of practices in rhythm with the water, and the replacement of traditional architecture in flood zones are also observed, which generates impacts on the territory and communities, as well as environmental and humanitarian emergencies, especially in multi-annual climate cycles (Figure 16 and Figure 17).

Revista Hábitat Sustentable Vol. 14, N°. 2. ISSN 0719 - 0700 / Págs. 98 - 111
https://doi.org/10.22320/07190700.2024.14.02.08

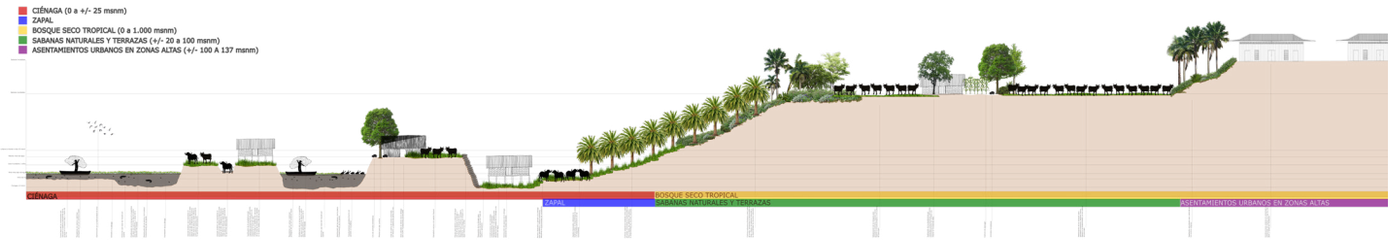

Figure 16. Identification of habitat conflicts. Source: Preparation by the Authors.

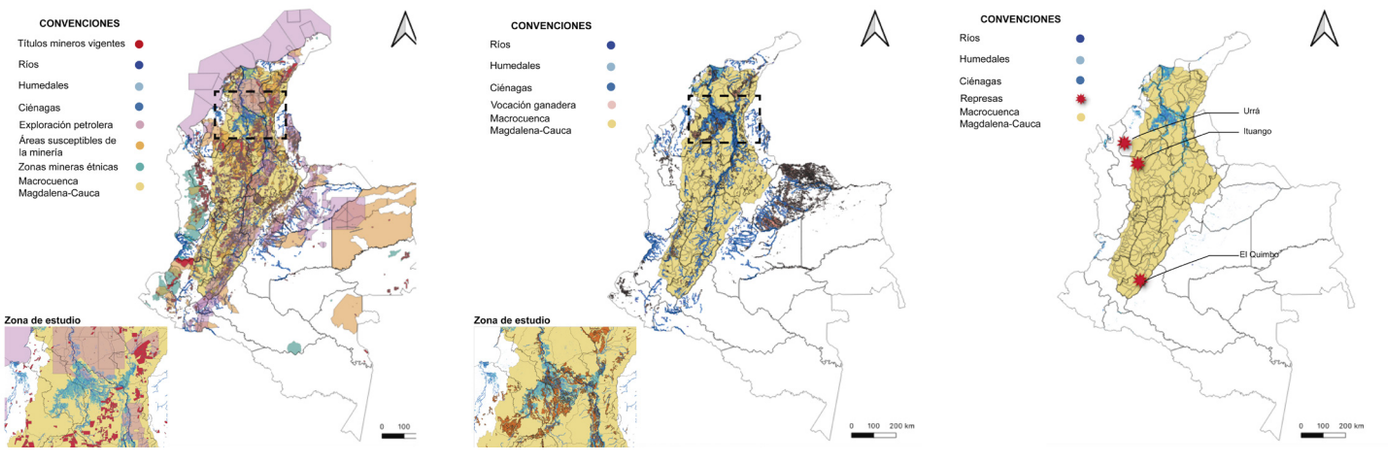

Figure 17. Regional conflicts: mining, livestock, and dams. Source: Preparation by María Camila Ramos Zapata.

Figure 18. Road fragmenting the marsh. Source: Preparation by the authors.

Figure 19. Houses for residents affected by floods. Source: Preparation by the authors.

Interventions encouraging this way of life and territory management have added to this. This has caused developments that run against the region's nature. These proposals intensify conflicts by action or omission, such as those in Figure 18 and Figure 19.

ADAPTATION AND RESILIENCE INDICATORS

Resilient and adaptation initiatives to current conditions that appeal to ecological wisdom were found (Liao et al., 2016). These promote associativity, ecosystem awareness for all generations, the recognition of the local, and safeguarding one's own (Figure 20). This is manifested in maintaining rhythms based on water pulses, traditional architecture, and knowledge associated with gastronomy, horticulture, fishing, and the production of objects. Reforestation, ecosystem recovery, and protection of local fauna are also promoted as a basis for their food security and the development of new sources of work and economy based on trade, tourism, and environmental services. Although there are few initiatives to address the broad needs of a complex region, the characterization shows the relics and survival of knowledge and practices in

ways of living that can be enhanced by recognizing the importance of this region and these socio-ecosystems for the country and the world.

MULTISCALE GUIDELINES

The information analysis allowed identifying the potential to understand and relearn how to work alongside the rhythms of water and the challenges to be faced in this region. These propose multiscale guidelines that guide public policy in its management (Table 1), considering the fundamental role of community and landscape planning in controlling anthropogenic impacts.

Due to the characteristics of the challenges, the urgency of intervention at the national level in the macro basin, regionally in the GDC, and locally in each of its three subregions is evident, which implies further development of its characterization. At the same time, elements were found in the local context that can provide solutions through the recovery of living practices and traditional architecture adapted to restore balance in the socio-ecological relationship. This can be the basis for a community process that, from the surviving knowledge, guarantees appropriate and equitable solutions outlined from the local needs and capacities. This consolidates inputs for the analysis, planning, and definition of policies and projects focused on the region that respects local particularities, promoting their conservation and supporting the necessary adaptation processes to the growing impacts of climate change on the hydraulic dynamics of the region.

Figure 20. Adaptation initiatives, from left to right environmental recovery and ways of living in Antequera, recovery of Zenú hydraulic knowledge in Purísima, and ecotourism initiative in La Rinconada. Source: Preparation by the authors.

Table 1. Summary of the DOFA and CAME analysis. Source: Preparation by the authors.

WEAKNESSES	NATIONAL	REGIONAL	LOCAL
		CORRECT	
Small municipalities. Deficient conservation and sustainable use efforts. Dispersed and absent administrative, economic, and management dependence.	Update the administrative policy framework considering their needs, decentralizing, and respecting the local dynamics.	Comprehensive territory management based on knowledge, conservation, and sustainable use of regional natural and cultural capital, focusing on resilience and adaptation.	
Limited socio-ecological management. Limited approach to resilience and adaptation. Poor accessibility and high cost of transportation. Low availability of services and infrastructure. High rates of poverty and inequality. Low quality of life, social mobility, migration, and disrespect of traditional cultural practices.	Including the region in the national framework guarantees the prevalence of socio-ecological needs.	Improve infrastructure, service provision, education, health, culture, transport, roads and media.	
Limited technical capacities for territorial management and planning. Fragmented and small-scale studies and interventions. Low recognition and valuation of the socio-ecosystem.	Focus efforts on the ecoregion's development, overcoming conflicts, and increasing the presence of the state.	Encourage interdisciplinary study and recognition of the region on a multiscale scale, from participatory scenarios, accompaniment, and technical and academic assistance.	

Revista Hábitat Sustentable Vol. 14, N°. 2. ISSN 0719 - 0700 / Págs. 98 - 111
https://doi.org/10.22320/07190700.2024.14.02.08

WEAKNESSES	NATIONAL	REGIONAL	LOCAL
	CORRECT		
Low support for organized communities and low level of partnership.	Prioritize policies to strengthen associativity.	Empower communities and strengthen associativity and cooperativism as forms of empowerment, participation, governance, and self-management.	
Lack of knowledge of the ecosystem characteristics associated with water.	Sensitize public officials and new inhabitants about the particular local conditions around water, the environmental role, and the possible solutions adapted from the region and not the other way around.		
Contamination from external sources.	Strengthen environmental and economic policies and regulations for prevention and correction.		
OPPORTUNITIES	EXPLOIT		
Survival of knowledge on adaptation to water.	Prioritize local knowledge over foreign interventions in formulating public policy and projects.	Identify, recognize, and value the surviving knowledge to promote its appreciation.	
Traditional knowledge balanced with nature.			
Biodiversity that promotes food security.		Promote knowledge, sustainable practices, and ecosystem conservation, which guarantee its defense and contribute to its protection.	
Freshwater reserve.			
Ecosystem with restoration potential.			
Ecotourism and cultural potential.		Consolidate points and routes of cultural and ecotourism tourism about local milestones, encouraging local communities to manage it.	
Unexplored, little studied, and valued cultural and identity potential			
Agricultural and fish farming potential.	Encourage sustainable agro-industrial development for food security, good living, and social mobility by integrating locally produced regional products into the market.		
The habitat and the traditional architecture respond adequately to the challenges of climate change.	Promote the appreciation and value of local practices and their regulatory acceptance.		
STRENGTHS	MAINTAIN		
Flood cycles generate rich food security and biodiversity.	Use clear and coherent interventions to raise awareness of the region's specific characteristics.	Guarantee the safeguarding and protection of knowledge about the region's ecosystem management.	
		Encourage efficient but sustainable agricultural and fishing practices that are not extractivist and controlled.	
Great cultural diversity.	Promote the region and its recognition, especially its ecological character. This would expand the offer of tourist services complementary to those already recognized.		
Survival of knowledge related to traditional ways of living and architecture.	Raise awareness about this knowledge's value and promote its learning as an input for regional and global intervention in similar situations.		
	Support local and regional cultural and tourism developments.		
Local communities committed to conservation.		Encourage the formation of groups interested in their recognition, safeguarding, and promotion with accompaniment and technical assistance.	
THREATS	FACE		
Centralized policies of little scope in the territory.	Ensure decentralization and equity in the management of the region's resources.	Consolidate regional efforts that cooperate in the management and injection of resources.	
Climate change.	Sustainable development strategies in all fields. Policies and plans for reforestation and soil recovery, comprehensive water resources management, agricultural adaptation, and ecological restoration in degraded areas.		
Annual and multi-annual flood rates.	Identify the particularities of the ecosystem to promote recognition and learning of how it works as an input for interventions that recognize its own dynamics.		
Development outside the natural dynamics of water.			
Regional inequality of access to resources with significant extractivism.	Strengthen environmental and economic policies and regulations for prevention and correction, which encourage appropriation for the defense and conservation of their ecosystem wealth.		
Deficient environmental policies that allow important transformations in the territory (containment or diversion of water, savannization, deforestation, and desiccation).			
Local environmental conflicts and other river sectors (mining, dams, livestock, intensive crops, deforestation).			
Armed conflict, drug trafficking, illegal mining.			
Promotion of foreign ways of living and architecture without suitable environmental response	Recognize, document, value, and promote their protection.		

These are nodes of intervention that can contribute to sensitizing the local and foreign populations to the urgent need to respect and adapt to water cycles. This implies a different approach to managing the territory based on water and not against it, revealing the importance of multiscale work.

DISCUSSION

The bibliographic review revealed many studies and regulations on the basin and the GDC, which show the relationship between conflicts at the basin level and the impacts on the wetlands. However, the problems are enormous and profound, given the lack of knowledge about local phenomena, which reflects a lack of instruments for such centralized territory management. It is impossible to solve problems only from the central or local context without establishing communication channels and participation at the different levels. Thus, the interventions proposed must be consistent with regional needs. This project line showed the importance of recognizing and recovering the living practices and adapting them to the new environmental and social conditions, which reference the knowledge linked to architecture, the ecosystem, and local urbanism.

This project complements previous efforts by preliminarily characterizing some indicators of adaptation and resilience of communities. This information is essential to formulate solutions to the socio-environmental challenges of the region. The characterization will serve as input for the next stage, where the communities have agreed upon socio-ecological restoration nodes. These promote empowerment and rooting, strengthening local capacities based on indigenous knowledge without invasive interventions and encouraging participation in public policies.

Assessing the ways of living allows keeping, conserving, and relearning relationships with water, resilience, and adaptation to contemporary challenges. This leaves open the need to continue the recognition process in other areas of the region and activate new points of work for recovery, conservation, and safeguarding.

CONCLUSIONS

The three subregions of the GDC are vital for human ecology and sustainability. Despite their cultural and ecosystem differences, they suffer from similar problems that threaten survival, causing adverse impacts that take the socio-ecosystem to the point of no return, as is already evident in some sectors.

Their communities' quality of life and social mobility are at risk, which requires adaptation, resilience, understanding, and relearning how to work with water and its rhythms in this region.

The recovery of forms of life and their adaptation to new conditions through knowledge linked to local architecture and urbanism requires joint work between the parties to strengthen communities from their knowledge.

Conceiving management with a socio-ecological approach can counteract the external pressures currently affecting the region. Given its socioeconomic and environmental relevance, this promotes a more efficient self-management of the territory as a viable and necessary alternative, integrates efforts, and increases the country's and the world's representativeness.

CONTRIBUTION OF AUTHORS CREDIT

Conceptualization, A.C.S.; Data curation, A.C.S.; Formal analysis, A.C.S.; Acquisition of funding A.C.S.; Research, A.C.S. and E.G.A.; Methodology, A.C.S.; Project management, A.C.S.; Resources, V.I.E.F.A.; Supervision, A.C.S.; Validation, A.C.S.; Visualization, A.C.S. and M.C.R.Z.; Writing - original draft, A.C.S.; Writing - revision and editing, A.C.S.

ACKNOWLEDGMENTS

Thanks are given to the communities of the El Pozuelo-Bolívar marsh, the Manatí-Antequera Foundation, Apropapur-Purísima, Antonio Herazo-Sincelejo, Edith González Afanador for building the environmental component of the research María Camila Ramos Zapata for drawing the maps, and the Vice-Dean of Research and Outreach of the Faculty of Arts for financing the project.

BIBLIOGRAPHIC REFERENCES

Aguilera Díaz, MM (Ed.). (2004). *Documento de trabajo sobre Economía Regional. La Mojana: riqueza natural y potencial económico* (48). Banco de la República. Centro de Estudios Económicos Regionales (CEER) - Cartagena. https://www.banrep.gov.co/sites/default/files/publicaciones/archivos/DTSER-48.pdf

Aguilera-Díaz, MM (Ed.). (2011). *La economía de las ciénagas del Caribe colombiano*. Colección de Economía Regional Banco de la República. https://www.banrep.gov.co/sites/default/files/publicaciones/archivos/lbr_economia_cienagas.pdf

Billon, P. L., Roa-García, M. C., y López-Granada, A. R. (2020). Territorial peace and gold mining in Colombia: local peacebuilding, bottom-up development and the defence of territories. *Conflict Security And Development, 20*(3), 303-333. https://doi.org/10.1080/14678802.2020.1741937

Camacho, J. (2015). Paisaje y patrimonio en La Mojana, Caribe colombiano. *Geografia Ensino & Pesquisa,19,*90-100. https://doi.org/10.5902/2236499419378

Camacho Segura, J. (2017). Acumulación tóxica y despojo agroalimentario en La Mojana, Caribe colombiano. *Revista Colombiana De Antropología, 53*(1), 123–150. https://doi.org/10.22380/2539472X.5

Camacho Segura, J., y Robledo Escobar, N. (2020). Indivisos, esquema colectivo y prácticas de propiedad campesina en Colombia. *Antípoda. Revista De Antropología Y Arqueología, 1*(40), 29-51. https://doi.org/10.7440/antipoda40.2020.02

Calderón-Contreras, R. (Coord.). (2021). Los sistemas socioecológicos y su resiliencia: casos de estudio. Universidad Autónoma Metropolitana, Unidad Cuajimalpa, Cuidad de México. Gedisa Editorial. https://ri.uaemex.mx/bitstream/handle/20.500.11799/67867/LosSSEysuResiliencia_CasosdeEstudio.pdf

Consejo Nacional de Política Económica y Social República de Colombia. Departamento Nacional de Planeación [CONPES]. (2022). La Mojana: territorio resiliente, sostenible, productivo y competitivo. https://colaboracion.dnp.gov.co/CDT/Conpes/Econ%C3%B3micos/4084.pdf

Corporación OSSO. (2013). Patrones en la configuración de riesgos y condiciones de vulnerabilidad asociados con la ruptura de diques en Colombia. https://www.preventionweb.net/english/hyogo/gar/2013/en/bgdocs/OSSO,%202012c.pdf

Coscia, C., y Voghera, A. (2022). Resilience in action: The bottom up! architecture festival in Turin (Italy). *Journal Of Safety Science and Resilience, 4*(2), 174-187. https://doi.org/10.1016/j.jnlssr.2022.10.005

de Nieto, C. P., y Falchetti, A. M. (1981). El legendario Zenú. *Boletín Museo del Oro,* (12), 20–33. https://publicaciones.banrepcultural.org/index.php/bmo/article/view/7310

Diz Diz, R. A. (2021). La Mojana Bolivarense, lucha agraria y actores armados 1980-1995. *Revista Alaüla, 4*, 114–121. Recuperado a partir de https://revistas.unicartagena.edu.co/index.php/revistaalaula/article/view/3480

García-Reyes Röthlisberger, M., y Fajardo, S. A. (2019). Saberes compartidos del hábitat: una arquitectura para el paisaje rural. Revista Unidades Dearq, 1(24), 34-47. https://doi.org/10.18389/dearq24.2019.03

Greco, S. E., y Larsen, E. W. (2014). Ecological design of multifunctional open channels for flood control and conservation planning. *Landscape And Urban Planning, 131*, 14-26. https://doi.org/10.1016/j.landurbplan.2014.07.002

Jaimes Pereira, A. y Zerbone Alves de Albuquerque, M. (2022).5. *Las prácticas socioambientales y la constitución del territorio en la región de la Depresión Momposina, Colombia* en A. González Serna y C. E. Fernández Gómez. *Desafíos bajo el dominio del capital. Efectos en el trabajo, la Riqueza y la producción.* Universidad Pontificia Bolivariana. http://doi.org/10.18566/978-628-500-064-5

Liao, K-H., Le, T. A., y Van Nguyen, K. (2016). Urban design principles for flood resilience: Learning from the ecological wisdom of living with floods in the Vietnamese Mekong Delta. *Landscape and Urban Planning*, *155*, 69-78. https://doi.org/10.1016/j.landurbplan.2016.01.014

Marrugo-Negrete, J., Paternina-Uribe, R., Enamorado-Montes, G., Herrera-Arang, J., Rosso-Pinto, M., Ospino-Contreras, J., y Pinedo-Hernández, J. (2024). Groundwater quality assessment in the La Mojana region of northern Colombia: implications for consumption, irrigation, and human health risks, *Applied Water Science, 14,* 96. https://doi.org/10.1007/s13201-024-02156-9

Medina, CP, Zubillaga, M. de las M., y Taboada, M. Á. (2014). *Suelos, producción agropecuaria y cambio climático: avances en la Argentina.* Ciudad Autónoma de Buenos Aires: Ministerio de Agricultura, Ganadería y Pesca de la Nación. https://www.researchgate.net/profile/Ricardo-Vicari-2/publication/268804903_Resiliencia_de_humedales_frente_al_cambio_climatico/links/56661d8a08ae15e74634c621/Resiliencia-de-humedales-frente-al-cambio-climatico.pdf

Meza-Martínez, M., De La Ossa-Velázquez, J., Hernández-Gómez, J., y Marrugo-Negrete, J. (2020). Mercurio total en hígados de Trachemys callirostris (Gray, 1856) (Testudines: Emydidae) en tres zonas de la Mojana, Sucre-Colombia. *Revista UDCA Actualidad & Divulgación Científica, 23*(1). https://doi.org/10.31910/rudca.v23.n1.2020.1239

Mosquera-Torres, G., y Calderón-Franco, A. M. (Eds.). (2022). Vivienda y cultura. Modos de habitar y construir la vivienda en el espacio urbano y rural en Colombia. Universidad del valle.

Nguyen, N. T., Friess, D. A., Todd, P. A., Mazor, T., Lovelock, C. E., Lowe, R., Gilmour, J., Chou, L. M., Bhatia, N., Jaafar, Z., Tun, K., Yaakub, S. M., y Huang, D. (2022). Maximising resilience to sea-level rise in urban coastal ecosystems through systematic conservation planning. *Landscape And Urban Planning, 221*, 104374. https://doi.org/10.1016/j.landurbplan.2022.104374

Observatorio de conflictos ambientales Universidad Nacional de Colombia [OCA] e Instituto de Estudios Ambientales [IDEA]. (2017). Infraestructura navegabilidad y puertos-Cormagdalena-Navelena-Magdalena medio y bajo. Análisis ecosistémicos. https://oca.unal.edu.co/investigacion/docs/Navegabilidad_rio_Magdalena/ProyNavegab%20ImpEcosist.pdf

Olmos-Severiche, C., González-Agudelo, E. M., Vélez-Macías, F. de J. y Aguirre-Ramírez, N.J. (2022). Los canales Zenúes en Colombia: un desaparecido en el territorio y un desconocido en el bolsillo. *Intropica, 17*(1), 132–145: https://doi.org/10.21676/23897864.4052

Organización Panamericana de la Salud [OPS] y Organización Mundial de la Salud [OMS]. (2023). Emergencia en La Mojana 2021-2023. Crónicas y lecciones aprendidas. OPS. https://www.paho.org/sites/default/files/emergencia_en_la_mojana_0.pdf

Palencia Mendoza, M. A. (2019). Mojana: diseño de viviendas palafíticas para la reducción y mejoramiento del déficit y las condiciones habitacionales en zonas inundables de la comunidad de Orejero - Sucre [Tesis pregrado, Universidad del Norte].

https://manglar.uninorte.edu.co/handle/10584/10405#page=1

RAMSAR. (2018). Perspectiva mundial sobre los humedales. Convención RAMSAR. https://www.ramsar.org/sites/default/files/flipbooks/ramsar_gwo_spanish_web.pdf

Rivera-Cediel, H. C. (2024). Cuerpos de agua: un derecho salvaje para el antropoceno a partir de las ciénagas de La Mojana [Tesis Doctorado, Universidad de los Andes]. https://doi.org/10.57784/1992/74198

Smardon, R. C. (2006). Heritage values and functions of wetlands in Southern Mexico. *Landscape And Urban Planning, 74*(3-4), 296-312. https://doi.org/10.1016/j.landurbplan.2004.09.009

Torres Solórzano, V. (2023). Gobernar las inundaciones: las intervenciones del Estado y las acciones de la población en La Mojana de Ayapel entre 2010 y 2022 [Tesis Magíster, Universidad de Antioquia]. https://bibliotecadigital.udea.edu.co/bitstream/10495/36066/1/Torres%20Vanessa_2023_GobernarLasInundaciones.pdf

Torres Carral, G. A. (2021). Acerca del concepto de socioecosistema: Un análisis eco-social. *Textual,* (77), 89–114. https://doi.org/10.5154/r.textual.2021.77.03

Torremorell, A., Hegoburu, C., Brandimarte, A. L., Rodrigues, E. H. C., Pompêo, M., Da Silva, S. C., Moschini-Carlos, V., Caputo, L., Fierro, P., Mojica, J. I., Matta, Á. L. P., Donato, J. C., Jiménez-Pardo, P., Molinero, J., Ríos-Touma, B., Goyenola, G., Iglesias, C., López-Rodríguez, A., Meerhoff, M., Pacheco, J. P., Teixeira de Mello, F., Rodríguez-Olarte, D., Barrios Gómez, M., Vicente Montoya, J., López-Doval, J.C. y Navarro, E. (2021). Current and future threats for ecological quality management of South American freshwater ecosystems. *Inland Waters, 11*(2), 125-140. https://doi.org/10.1080/20442041.2019.1608115

Urango-Cárdenas, I., Enamorado-Montes, G., Burgos-Nuñez, S., Marrugo-Madrid, S., Paternina-Uribe, R., Marrugo-Negrete, J., y Díez, S. (2024). Unravelling arsenic bioavailability in floodplain soils impacted by mining activities. The *Science of the Total Environment*, *947*, 174193. https://doi.org/10.1016/j.scitotenv.2024.174193

Vargas, H., Bermúdez, E., Ibatá, L., Vargas, A. M., y Díaz, C. (2023). La *Mojana 2030: un país posible. Propuestas para ordenarla alrededor del agua.* Planeación & Desarrollo. https://colaboracion.dnp.gov.co/CDT/PublishingImages/Planeacion-y-desarrollo/2023/octubre/pdf/la-mojana-2030-un-pais-posible.pdf